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AIR COOLER FOR HYPERSONIC WIND TUNNELS

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ABSTRACT. A patent has been issued for an air cooler for hypersonic wind tunnels consisting of an outer housing, heat lens equalizers, a water intake and output system, and a water cooling element made of metal pipes arranged parallel to the flow. Efficiency and reliability are increased by welding the intake side of the cooling element to the diffuser-output section of the wind tunnel, and welding the output section of the air cooling element across the prestressed (stretched) equalizer to the air cooler's outer housing; the output flange of the diffuser is welded across the lens equalizer part of the air cooler housing without prestressing the equalizer. Overheating of the outer part of the diffuser is decreased by feeding water in discrete, pressure driven streams through an injector pipeline.

Air tube heat exchangers for cooling of gases with high initial temperature, using longitudinal distribution of the tubes fastened into tube banks containing heat compensators and a system for supplying cooling water are already known. /1[1]

In order to increase the effectiveness of cooling of the stream and to increase the reliability of operation of the air cooler, the input side of the air cooling element in the air cooler is welded to the output portion of the diffuser of the wind tunnel, while its output side is welded through a prestressed (stretched) compensator to the outer body of the air cooler. The input flange of the diffuser is welded through a lens shaped compensator to the external body of the air cooler without prestressing of the compensator.

Also, in order to reduce overheating of the outer portion of the output sector of the diffuser, a pipe with injectors is installed beneath its lower surface, through which water is fed in the form of discrete streams under pressure.

The drawing shows a longitudinal cross section of the air cooler suggested, as well as a cross section through A-A.

The cylindrical outer body (1), welded up of sheet carbon steel and reinforced internally with ribs, has an external movable mount (2), which supports the weight of the entire structure plus water. Body (1) carries flanges (3) for attachment of the cooling water lines, flanges (4) for sludge drainage,

[1] Numbers in the margin indicate pagination in the foreign text.

flanges (5) for water drainage, two mounting ports (6) and lugs (7) beneath the guide key. The level of the water placed into body (1) for cooling is controlled by indicator (8). In order to create a vapor space volume, the external body has an attached cylindrical sector.

The internal body (9) is welded up of individual parts and consists of the output sector of the supersonic diffuser (10), heat chamber (11) and steel tubes (12), which are welded into the forward tube bank (13) and the rear tube bank (14). In order to avoid overheating of the lower portion of the diffuser, a pipeline with injectors (15) through which water is fed in the form of individual streams under pressure, is fastened below the diffuser at the outer surface. Body (9) has fixed mounts (16) in the sector around the heater chamber (11), and movable mounts (17) at the end of the tubes (12) in the cylindrical sector. In order to compensate for thermal expansion of the structure of the internal body and tubing, two lens shaped compensators (18) are connected along the length of the air cooler.

The vapor which does not condense to water passes through aperture (19) in body (1) and exits into tube (20).

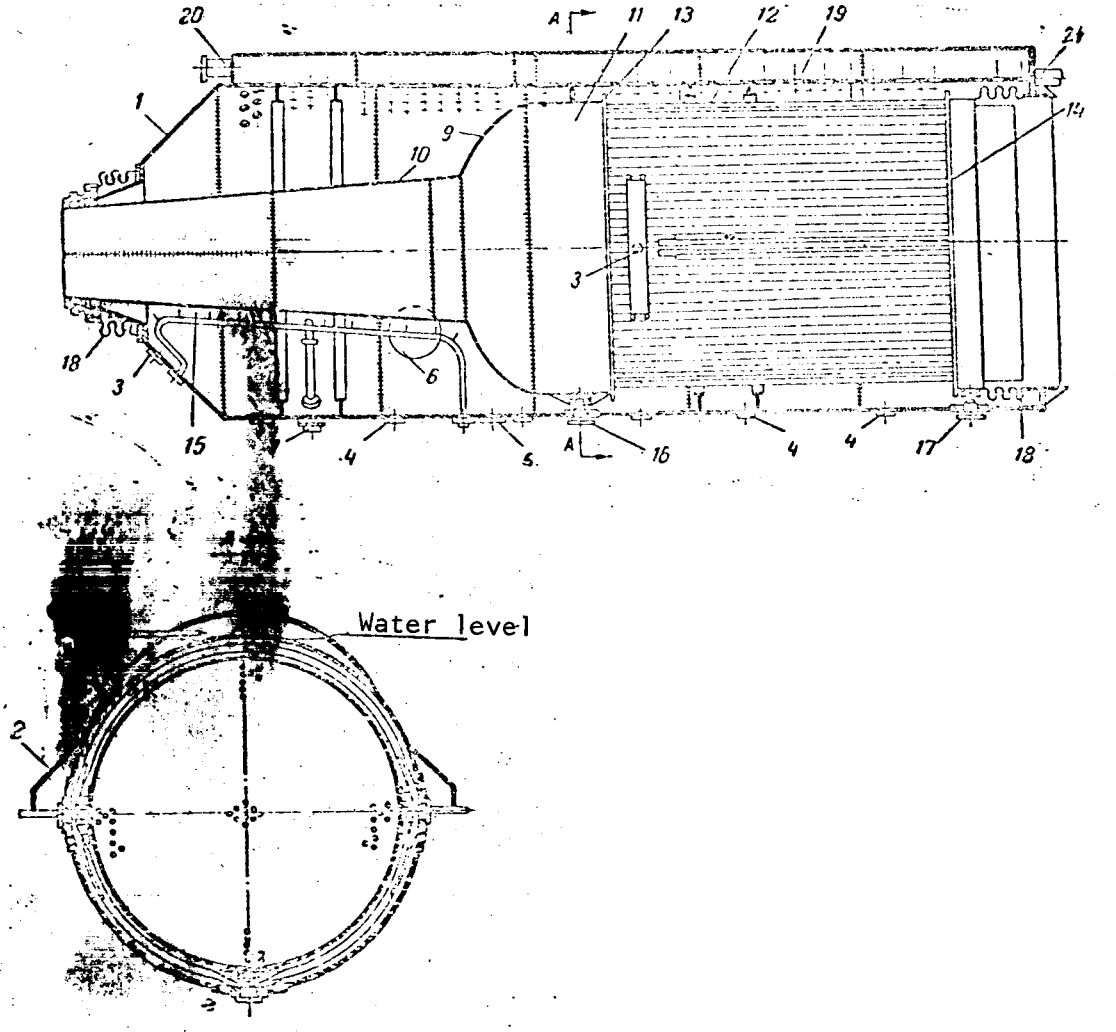
The excess cooling water passes through drainage tube (21). /2

Tubes (12) are located and welded into the tube banks in a manner similar to the tubes in a steam generating boiler. However, in this design during heating the tubes are not subjected to compression, but rather to extension due to the placement of the preliminarily stretched lens shaped compensator (18), which is stretched before it is welded to the outer body.

Patent Claims

1. An air cooler for hypersonic wind tunnels containing an external body, lens shaped heat compensators, a system for supply and drainage of water and an air cooling element, made up of metal tubes oriented along the direction of flow, the ends of which are fastened into tube banks, differing in that in order to increase the effectiveness of cooling of the flow and increase the reliability of the operation of the air cooler, the intake side of the air cooling element is welded to the output portion of the wind tunnel diffuser, while the output side of the air cooling element is welded to a prestressed (stretched) compensator to the outer body of the air cooler, and the intake flange of the diffuser is welded through a lens shaped compensator to the outer body of the air cooler without prestressing of the compensator.

2. Air cooler according to claim 1, differing in that, in order to decrease overheating of the external portion of the output sector of the diffuser, a pipe with injectors is installed beneath the lower surface of the diffuser, and water is fed in in the form of discrete streams under pressure.



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